

In re Patent Application of:
VAIL ET AL.
Serial No. 09/991,559
Filing Date: **NOVEMBER 9, 2001**

REMARKS

The Examiner is thanked for the thorough examination of the present application. The specification has been amended to more clearly delineate the description therein of the capacitance variation determination feature recited in Claims 45-47.

Moreover, independent Claim 1 has been amended to correct the noted informality, as helpfully pointed out by the Examiner. As such, the noted objections to these claims should be withdrawn.

In view of the foregoing and the arguments presented in detail below, it is submitted that all of the claims are patentable.

I. The Claimed Invention

The present invention is directed to a temperature sensor. As recited in independent Claim 1, for example, the temperature sensor includes a capacitor, a circuit element coupled in series with the capacitor and having a resistance that varies with temperature, and a plurality of calibration resistors coupled to the capacitor and having different resistance values. The temperature sensor also includes a controller for sequentially charging the capacitor through the circuit element and each of the calibration resistors. The controller is also for measuring respective charging times required to charge the capacitor to the predetermined threshold through the circuit element and the calibration resistors, and determining the temperature based upon the charging times. Accordingly, the temperature sensor not only provides a high degree of accuracy,

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but it is also easy to calibrate.

Independent Claim 19 is directed to a similar temperature sensor, and independent Claim 33 is directed to a related method. Each of these claims similarly recites charging a capacitor through a circuit element/thermistor and a plurality of calibration resistors, measuring charging times associated with each, and determining temperature based upon the charging times.

II. The Claims Are Patentable

The Examiner rejected independent Claims 1, 19 and 33 based upon Levine et al. (U.S. Patent No. 4,841,458) in view of Lobban (U.S. Patent No. 6,612,737). Levine et al. is directed to a method for forming a digital signal representing an environmental condition, such as temperature. The method includes measuring the variable time constant of an analog sensing device having a variable resistance dependent upon the environmental condition and a capacitor, as well as measuring the reference time constant of a precision fixed resistor and the same capacitor. The time constants are measured by discharging the capacitor, charging the capacitor through the appropriate element, and measuring the time for the voltage across the capacitor to reach a predetermined level. Lastly, the digital ratio between the two time constants is formed. This digital ratio is the digital representation of the temperature by the analog sensing device. See, e.g., abstract of Levine et al.

The Examiner correctly acknowledges that Levine et al. fails to teach the use of a plurality of calibration resistors

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each having different values. Nonetheless, the Examiner contends that Lobban provides this noted deficiency. Lobban is directed to a self-calibrating temperature sensor which includes a controller, a multiplexer having a low on-resistance, two or more calibration reference resistors, and a current-to-frequency converter that performs self-calibrated temperature sensing with temperature sensing devices such as resistance temperature detectors (RTDs). In general, the system performs self-calibrated temperature sensing by using the current-to-frequency converter to provide a constant voltage sequentially to the calibration resistors and one or more RTDs using switches having low on-resistance in the multiplexer, which is controlled by the controller.

The value of one of the reference resistors is correlated to the resistive value of the RTD at the minimum temperature of the operating temperature range for equipment to be monitored, and the value of another reference resistor is correlated to the resistive value of the RTD at the maximum temperature of the operating temperature range for the processing equipment. The values of additional reference resistors, if included, correlate to the resistive values of the RTD at selected intermediate temperatures within the temperature range for the processing equipment. The frequency output by the current-to-frequency converter varies directly with current variation, and thus inversely with the resistance of the individual calibration resistor or RTD. The controller determines composite resistance for the calibration resistors and RTDs from

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the frequencies output by the current-to-frequency converter. A calculation is performed using these resistances to determine temperature values for the RTDs and the equipment with which they are associated. See, e.g., abstract of Lobban.

It is respectfully submitted that the rejection of independent Claims 1, 19 and 33 is in error, as this rejection constitutes improper hindsight reconstruction of the prior art based upon the claimed invention. As the Examiner is no doubt aware, to establish a prima facie case of obviousness, there must be some suggestion or motivation provided by the prior art for making a proposed combination of references. Moreover, the references must be considered in their entirety, including portions that teach away from the claimed invention (see MPEP 2141.02).

In this regard, Lobban teaches using a current-to-frequency converter for applying a voltage to different calibration resistors, and calculating temperature based upon the frequencies output by the current-to-frequency converter (which vary with current, or inversely with the resistance of the calibration resistors). The reason that two calibration resistors are used in the Lobban device is to correlate the minimum and maximum values of the operating temperature range for the equipment being monitored.

In stark contrast, Levine et al. is directed to a temperature sensing device which determines temperature based upon charging times for charging a capacitor through a variable temperature dependent resistance and a precision fixed resistor.

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Nowhere does Lobban (nor any of the remaining prior art of record) teach or fairly suggest that the calibration resistors thereof may be used in a temperature sensing device that operates using a completely different principle, i.e., based upon measured charging times.

Rather, the fact that Lobban teaches using calibration resistors for a completely different temperature sensing approach (i.e., using current-to-frequency conversion) would have lead those of skill in the art away from haphazardly adding such resistors to the Levine et al. device. Because it operates on a different principle, the Levine et al. device requires no operational range delineation, as does the Lobban device. Thus, selectively adding such operational range correlation resistors to the Levine et al. device would serve no purpose to one of ordinary skill in the art based upon the teachings of these references, so he would therefore have been discouraged from doing so. To find otherwise would require the impermissible use of the claimed invention in hindsight as a roadmap or template to piece together the teachings of the prior art.

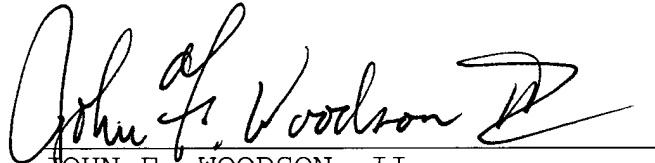
Accordingly, it is submitted that independent Claims 1, 19, and 33 are patentable over the prior art. Their respective dependent claims, which recite yet further distinguishing features, are also patentable over the prior art and require no further discussion herein.

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CONCLUSIONS

In view of the foregoing, it is submitted that all of the claims are patentable. Accordingly, a Notice of Allowance is respectfully requested in due course. Should any minor informalities need to be addressed, the Examiner is encouraged to contact the undersigned attorney at the telephone number listed below.

Respectfully submitted,

A handwritten signature in cursive script, reading "John F. Woodson, II". The signature is written in dark ink and is positioned above a horizontal line.

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